Feb. 21, 1967 R. M. EIDAL 3,305,245

VEHICLE SUSPENSION SYSTEM

Filed Dec. 29, 1964 2 Sheets-Sheet 1

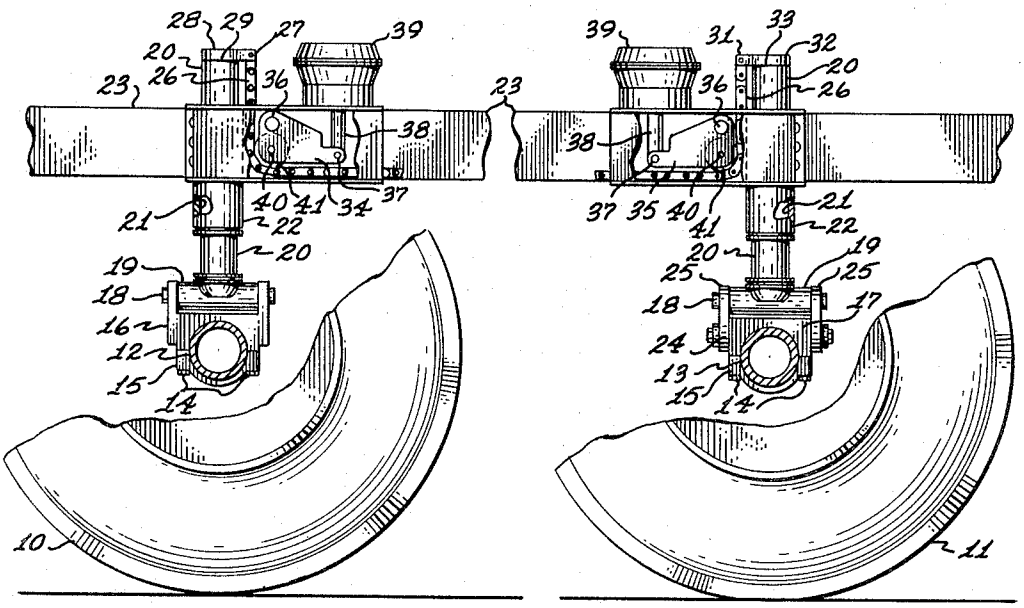


FIG. 1

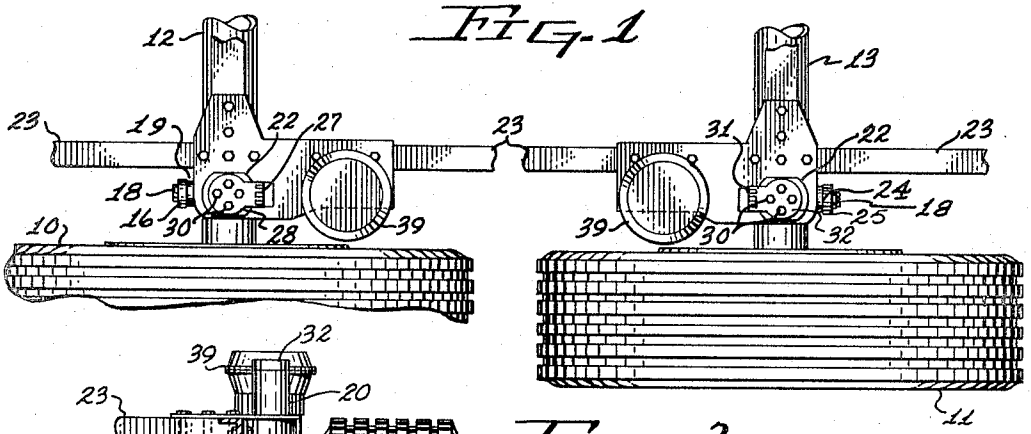


FIG. 3

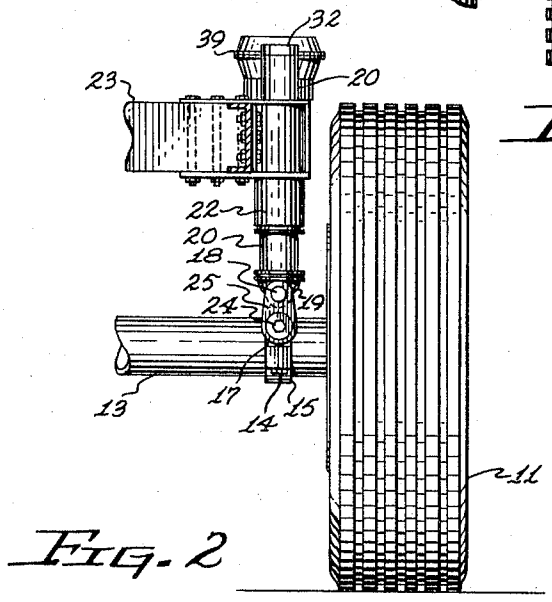


FIG. 2

INVENTOR.
ROY M. EIDAL
BY
Willard S. Dowe
ATTORNEY

Feb. 21, 1967 R. M. EIDAL 3,305,245

VEHICLE SUSPENSION SYSTEM

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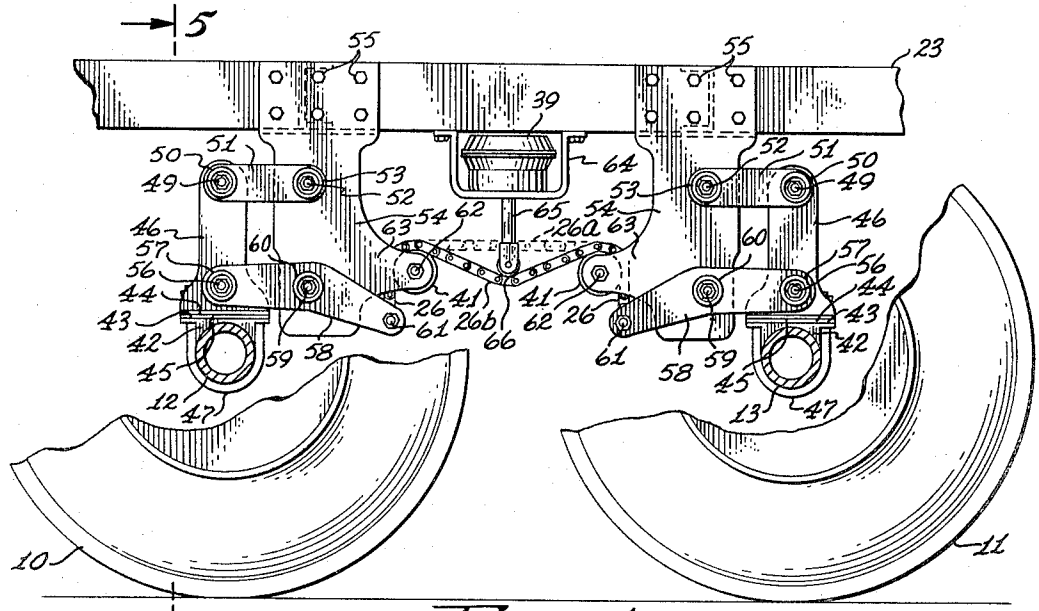


FIG. 4

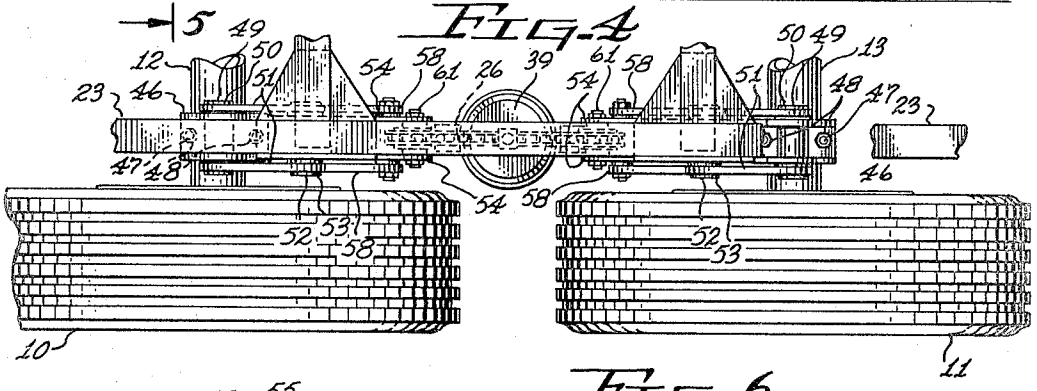


FIG. 6

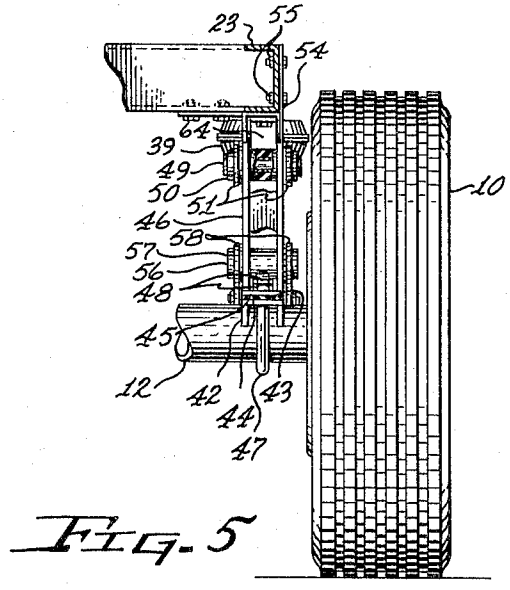


FIG. 5

INVENTOR.
ROY M. EIDAL
BY
Willard S. Brown
ATTORNEY

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3,305,245

VEHICLE SUSPENSION SYSTEM

Roy M. Eidal, 250 Woodward Road SE., Albuquerque, N. Mex. 87102

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This invention pertains to vehicle suspension systems and is particularly directed to chain suspension system particularly adapted to heavy load carrying trailers and they like.

One of the objects of this invention is to provide a suspension system that is free of vibration and loose joints and which is readily adapted to various loads and empty conditions for the vehicle so as to preserve good riding qualities and long tire life under all operating conditions.

Another object is to provide a chain suspension system for a multi-wheel trailer that allows the wheels free and independent vertical movements in response to irregularities in the road surface while tying their movements together through a chain tensioned through air suspension cylinders supporting the load carrying bed of the vehicle.

A further object is to tie together the vertical movements of the various road wheels through an interconnecting chain and to suspend the load carrying by lateral pressure applied to the side of the interconnecting chain.

Another object is to provide a chain suspension system for a motor vehicle that is free of sliding surfaces and springs so as to provide a suspension system of substantially friction free character and long life.

Further features and advantages of this invention will appear from a detailed description of the drawings in which:

FIG. 1 is a side elevation of a chain suspension system incorporating the features of this invention.

FIG. 2 is an enlarged fragmentary sectional view on the line 2—2 of FIG. 1.

FIG. 3 is a fragmentary plan view of the apparatus shown in FIG. 1.

FIG. 4 is a side elevation of a modification of the apparatus shown in FIG. 1.

FIG. 5 is an enlarged fragmentary sectional view on the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary plan view of the apparatus shown in FIG. 4.

As an example of one embodiment of this invention, there is shown a vehicle such for example, a heavy duty trailer having forward road wheels **10** and rear road wheels **11** appropriately journaled on suitable transverse axles **12** and **13**. Rigidly clamped to each of the axles **12** and **13** by suitable bolts **14** and caps **15** are the blocks **16** and **17**. The block **16** is directly pivotally connected by a pin **18** to the lower end **19** of the guide column **20** which in turn is slidably mounted for vertical movement in the bore **21** of the guide sleeve **22** rigidly fixed to the frame **23** of the vehicle bed. The rear block **17** is pivotally connected at **24** to the lower ends of the links **25** whose upper ends are pivotally connected by the pin **18** to the lower end **19** of the rear guide column **20** which is slidably mounted for vertical movement in the bore **21** of the rear guide sleeve **22** rigidly fixed to the frame **23**, this arrangement providing for the proper freedom of lateral articulated movement of the road wheels and axles in accommodation to irregularities in the road surface.

One form of the suspension system of this invention comprises a link chain **26**, one end **27** of which is fixed to a block **28** rigidly secured to the upper end **29** of the forward guide column **20** by suitable screws **30** while the other end **31** of the chain **26** is fixed to a block **32** rigidly

secured to the upper end **33** of the rear guide column **20**. A pair of oppositely disposed idler levers **34** and **35** are each pivotally mounted on suitable pins **36** suitably fixed in the frame **23** adjacent the respective guide sleeves **22**. The outer ends of the idler levers are each connected by a suitable pin **37** to the outer ends of the downwardly extending piston rods **38** of suitable fluid pressure cylinders **39** fixed to the frame **23**. Suitably journaled on a pin **40** located intermediate the ends of the levers **34** and **35** and below the pins **36** are the idler rollers **41**. As best seen in FIG. 1, the link chain extends downwardly from the block **28** around and under the idler roller **41**, then horizontally rearwardly, then under and upwardly in contact with the other roller **41** to the block **32**. It is to be understood that the described structure is provided for the road wheels **10** and **11** at both sides of the vehicle.

By applying appropriate pressure, such as air, in the cylinders **39** the outer ends **37** of the levers **34** and **35** are yieldingly held in a downwardly direction while the rollers **41** laterally engage and ride on and are supported by the chain **26** so as to support the frame **23** through the blocks **28** and **32** and guide columns **20** on the road wheels **10** and **11**. It can thus be seen that upward movement of one set of forward wheels **10** relative to the frame **23** causes, through the chain **26**, equivalent downward movement of the rear wheels **11** relative to the frame while the cylinders maintain a cushioned soft stable position in ride for the vehicle frame **23** and the bed and load carried thereon.

A modification of the above described apparatus incorporating the same basic principles of operation is shown in FIGS. 4, 5 and 6 in which the road wheels **10** and **11** and associated axles are each connected by a parallelogram linkage system to the frame **23** of the vehicle. To this end there is provided a saddle piece **42** rigidly fixed to the upper portion of each axle having a horizontal top surface **43** to which is applied a resilient pad **44** of suitable material on top of which rests the bottom surface **45** of the parallel motion vertical link **46**. Suitable U-bolts **47** extending around the axles **12** and **13** and up through the plate **42**, pad **44**, and bottom **45** together with the nuts **48** serve to yieldingly secure the axles **12** and **13** to the vertical links while allowing sufficient movement therebetween for the articulated lateral movements of the respective axles and road wheels in response to the irregularities in the road surface.

The upper end of the vertical link **46** is pivotally connected at **49** by a suitable rubber bushing **50** to one end of the link **51** and the other end of the upper link **51** is pivotally connected at **52** by a rubber bushing **53** to a bracket **54** rigidly fixed to the vehicle frame **23** by appropriate bolts **55**. Intermediate the ends of the vertical link **46** is pivotally mounted at **56** by a rubber bushing **57** one end of the control link **58** which in turn is pivotaly mounted intermediate its ends at **59** by a rubber bushing **60** on the lower end of the bracket below the pivotal connection **52** of link **51** so as to provide a parallelogram of vertical up and down movement for the link **46** and attached axles **12** and **13** and associated road wheels **10** and **11** free of all vertical sliding guide elements.

A chain **26** has its ends pivotally connected at **61** to the other ends of the control links **58** from the pivotal connection **56**. The chain **26** extends up and over the idler rollers **41** journaled at **62** on the integral extension portions **63** of the brackets **54**. A single fluid pressure cylinder **39** is fixed by a bracket **64** to the vehicle frame **23** and has a heavy downwardly extending piston rod **65** on the lower end of which is journaled a roller **66** which engages the chain **26** intermediate the rollers **41**.

When fluid pressure, such as air, is applied to the cyl-

inder, its piston roller **66** laterally deflects the chain between the rollers **41** from the substantially horizontal position **26***a* to the downwardly deflected position **26***b*, FIG. 4, of normal load carrying for the vehicle. Again upward movement of one wheel and axle **11–12** relative to the frame **23** through the chain **26**, causes downward deflection of the other wheel and axles **10–13** relative to frame **26** to thus maintain a smooth cushioned level ride for the vehicle.

While the apparatus herein disclosed and described constitutes a preferred form of the invention, it is also to be understood that the apparatus is capable of mechanical alteration without departing from the spirit of the invention and that such mechanical arrangement and commercial adaptation as fall within the scope of the appendent claims are intended to be included herein.

Having thus fully set forth and described this invention what is claimed and desired to be obtained by United States Letters Patent is:

1. A vehicle suspension system comprising in combination:

(A) a forward road wheel and axle assembly,
(B) a rear road wheel and axle assembly,
(C) a frame,
(D) guide sleeves fixed on said frame,
(E) a guide column fixed to each of said axles vertically reciprocatable in said guide sleeves,
(F) a pair of horizontally spaced idler rollers,
(G) an idler lever for each of said idler rollers pivotally mounted on said frame,
(H) yielding fluid cylinders on said frame connected to actuate said idler levers to swing said idler rollers radially,
(I) a length of chain having one end connected to one of said guide columns and its other end connected to the other of said guide columns and engaging said idler pulleys so that said guide columns are caused

to move in opposite directions relative to said frame while said yielding fluid cylinders are arranged to control the relative vertical position of said frame to both of said wheel assemblies.

2. A vehicle suspension system comprising in combination:

(A) a forward road wheel and axle assembly,
(B) a rear road wheel and axle assembly,
(C) a frame,
(D) a vertical link fixed to each of said axles,
(E) an upper link pivotally connected at one end to the upper end of said vertical link and pivotally connected at its other end to said frame,
(F) a control link pivotally connected at one end to the lower portion of said vertical link and pivotally connected intermediate its ends to said frame,
(G) a length of chain having its ends connected between the other ends of said lower links,
(H) idler rollers journaled on said frame laterally supporting said chain so that said wheel and axle assemblies move in opposite vertical direction relative to said frame,
(I) a fluid pressure device on said frame having an actuable element adapted to laterally engage said chain intermediate said rollers to simultaneously adjust the relative vertical position of said wheel and axle assemblies and said frame to desired load carrying position.

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BENJAMIN HERSH, *Primary Examiner.*

P. GOODMAN, *Assistant Examiner.*